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09/670,028	09/26/2000	Sveinn Olafsson	JEK/BEU/OLAFSSON	4704

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EXAMINER
PADGETT, MARIANNE L

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Please find below and/or attached an Office communication concerning this application or proceeding.

53

Office Action Summary	Application No. 09/670,028	Applicant(s) Sveinn Olafsson
	Examiner M.L. Padgett	Group Art Unit 1762

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

☒ Responsive to communication(s) filed on 12/5/00 + 1/31/00.

☐ This action is FINAL.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 1 1; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 1-46 is/are pending in the application.

Of the above claim(s) 17-46 is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) ~~1~~ 1-16 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claim(s) _____ are subject to restriction or election requirement

Application Papers

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).

☐ All ☐ Some* ☐ None of the:

☐ Certified copies of the priority documents have been received.

☐ Certified copies of the priority documents have been received in Application No. _____.

☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a))

*Certified copies not received: _____.

Attachment(s)

☐ Information Disclosure Stat ment(s), PTO-1449, Paper No(s). 4, 5

☐ Interview Summary, PTO-413

☐ Notice of Reference(s) Cited, PTO-892

☐ Notice of Inf rmal Patent Applicati n, PTO-152

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Other _____

Office Action Summary

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-16, drawn to a method of using thermal spikes or shockwaves generated by an electrode in a growth medium to process a material, classified in class 427, or 216, 204, 219, subclass 552^{+}, or (63^{+} or 94), 192.38, or 121.15^{+}, respectively.

II. Claims 17-29, drawn to an apparatus containing an electrode, such as an emitter tip, for treating material, classified in class 118, or 204, or 219, subclass 723R, or 298.4^{+}, 121.12^{+}, respectively.

III. Claims 30-46, drawn to a substrate that may have been coated or etched, and might have features $\leq$ about 90-20μm, classified in class 428, subclass 195 or 220.

2. Claims 1-8, 16-24, 29-37 and 42-46 are generic to a plurality of disclosed patentably distinct species comprising deposition and etching. Applicant is required under 35 U.S.C. 121 to elect a single disclosed species, even though this requirement is traversed.

Should applicant traverse on the ground that the species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

3. The inventions are distinct, each from the other because:

Inventions group I and group II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case whether

or not the apparatus has any effect on the substrate, depends on the materials of the substrate and the medium in which the electrode is employed. Furthermore, the size of the affected region is a method limitation, where the capability of effecting dimensions on the order of tens of μm or smaller does not exclude effecting lager dimensions.

4. Inventions group I and group III are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product has no particular shape or definable structural characteristics, as described in the independent claim, hence such virtually unlimited structures can be made by almost any technique.

5. Inventions group II and group III are related as apparatus and product made. The inventions in this relationship are distinct if either or both of the following can be shown: (1) that the apparatus as claimed is not an obvious apparatus for making the product and the apparatus can be used for making a different product or (2) that the product as claimed can be made by another and materially different apparatus (MPEP § 806.05(g)). In this case a product without clearly definable structure, can include an almost infinite variety of products made by a wide variety of apparatus.

6. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and the search required for Group II or III is not required for Group I, restriction for examination purposes as indicated is proper.

7. During a telephone conversation with Benjamin Urcia on 9/12 and 16/2002 a provisional election was made without traverse to prosecute the invention of group I method, claims 1-16. Affirmation of this election must be made by applicant in replying to this Office action. Claims 17-46 withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

It is noted that when discussing what set of claims was elected in the US case, both the examiner and the attorny forgot to discuss which species was elected. In order to move this case, both method species of coating and etching will be examined at this time.

8. Claims 1-16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In the last two lime of claim 1, the limitation of "an area" (a 2 dimensional quantity) is inconsistent with the units used to describe it (distance or one dimensional units), hence what dimensions are intended to describe the effected material are uncertain, or vague and indefinite. In lines 1-2 of claim 1, "a material", second occurrence, is objected to as using the wrong article for a previously introduced term, while "the temperature" lacks proper antecedent basic.

The term "growth medium" introduced in line 4 of claim 1, implies growth, i.e., deposition, on the material, however it is not positively claimed in the independent claim, since "affected" (line 7) is more generic", and some further dependent claims contradict the modifier of medium by implying that the medium (as its what's used in the process) causes etching. See claim 12-13 in particular for this ambiguity. Claims such as 10 or 11, which have both deposition and etching, might be considered to have the etching and/or cleaning preformed using entirely different technique, since there is no positive or definite relationship between the etching and the thermal spike/shockwave technique described in the independent claim, but deposition may be consider to have an implied relationship it is a form of growth.

Claim 4 is ambiguous, in that as written either the anode or the election could be considered to be what's "in a direction ... parallel to ...the material".

In claim 8, while the relative term "fast" is defined by "on the order of a few picoseconds to hundreds of nanoseconds", the exact scope intended tube covered is a bit fuzzy. For examination purposes, the interpretation of 1 psec to 999 nsec appears appropriate.

In claim 10, "the resulting product" and in claim 13 "said etch gas", are objected to as lacking proper antecedent basis.

In claims 14 and 15, lines 1-2 "growth of material" is vague and indefinite as it is unclear how this newly introduced material relates to that introduced in claim 1, as it has neither an article showing antecedence, nor any clear differentiation. Thus it is further unclear which one of the introduced materials is being referred to in the succeeding limitations of the claim that refer to "[the] material[s]". It is further noted that the limitation of "to permit recycling ..." is NOT a positive limitation, hence no recycling need ever occur as presently claimed.

9. The examiner has noted a discrepancy in the inventors between this U.S. case, and the child PCT/USO1/27729 case. The present case, according to the oath has Sveinn Olafsson as the sole inventor, while the PCT case lists Ernest Kenney with Mr. Olafsson. Both cases have the same claims. Due to this discrepancy the following rejection is made.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (f) he did not himself invent the subject matter sought to be patented.

Claims 1-16 are rejected under 35 U.S.C. 102(f) because the applicant did not invent the claimed subject matter. As noted above, the PCT raises dought as to who composes the inventive entity, hence clarification of the record is needed. Should another inventor be added to the applicants in this case, as suggested by copending Child case PCT/US01/27729? Or is there some other reason for the above note difference?

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 1-3, 5 and 8-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Güethner et al.

Güethner et al teach writing "submicron structures" on the surface of a substrate (a material) by positioning a scanning emitter tip electrode in nanometer range proximity or within current tunneling range, of the substrate surface. A series of short voltage pulses (4.0 volt height and width of 500 to 100ns, or 5.0 volts and widths less than 10 ns) are applied between the tip and the surface, which causes migration of atoms of tip material on the tip and transfer thereof to the surface. Both the tip and the substrate are electrically conductive, hence when the voltage pulses are applied there will inherently be resistive heat caused by the electron flow, and since it is in pulses there will inherently be "thermal spikes" accompanying the voltage pulses. Güethner et al teach that the tip may be either negative or positive with respect to the surface, so therefore the electrons may be flowing either to or from the tip, thus reading on an electron emitting tip electrode when the flow is from the tip.

Güethner et al suggest submicron writing applications on Si surfaces, such as to deposit nanometer-size circuited elements, or suggest use as data in data storage medium or as masks to use lithographically for circuits.

With non oxidizing tip material, such as gold, it is taught that "ambient" temperature and pressure conditions may be used, thus suggesting that the medium in which the process is preformed is gaseous (or air). Note that since it is never positively claimed, what the "growth medium" does, except to be present, the environment, i.e. gas, in which Güethner et al's process is preformed (gaseous) is considered to read on the growth medium, because it is a medium in which a growth process on the substrate occurs.

It is further taught that the deposited masks may also be erased, i.e. removed (hence reading on cleaned and/or etched) from the substrate surface by apparatus voltage pulses.

For the above discussed features, see the abstract; figures; col. 2, lines 1-65; col. 3. lines 12-67 and col. 4, lines 24-col. 5, line 2.

12. Claims 4 and 14-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Güethner et al as applied to claims 1-3, 5 and 8-12 above.

Güethner et al do not discuss separate "sub-areas" or "subcells" for growth (deposition) and erasing or removing (etching or cleaning) atoms from the surface after deposition, however it would have been obvious to one of ordinary skill in the art, that in order to perform Güethner et al's process under assembly line condition that one would choose different successive spots, areas, cells or however one chooses to label the location at which each successive step in preformed. As seen in the erasing discussion, this procedure removes material, such that it can be used for either reshaping deposits or eliminating ones that are undesirable (contaminates, dark spot defects, etc), and that the removed deposited material is transferred onto the tip opposite it, hence may be recycled. It would have been further obvious to one of ordinary skill in the art that contaminates that are not from the deposition tip, should be removed separately from those that are tip material, to avoid contaminating the tip, especially considering that the preferred deposition material for the tip is gold, thus providing economic motivation for ensuring that Au or previously deposited material that is recollected on the tip is not adulterated with contaminates.

Claim 4 is included in the 103 due to its ambiguity. Since the substrate is conductive it may be the anode and is parallel to itself, or it is obvious and convential to place the conductive

substrate on a plasma electrode which may serve as the anode, inorder to complete the circuit required.

13. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Güethner et al as applied to claims 1-3,(4), 5, 8-12 and 14-15 above, and further in view of Gallagher et al.

While Güethner et al suggest additional heating to enhance or facilitate the ability of material to be emitted or transferred (abstract; col. 2, lines 19-20 and col. 3, line 67 - col. 4, line 3), but does not discuss the means of heating employed. Gallagher teach that nanostructures may be intermittently heated by tunneling current from a emitter tip or laser irradiation (col. 10, lines 32-35 and col. 8, lines 44-65), hence it would have been obvious to one of ordinary skill, that when additional heating is desired other than that already supplied by the tip current as suggested in Güethner et al, that the use of laser irradiation which is known and taught to supply heat to equivalent structures would have been an effective heat source as it is shown to be used in analogous situations, equivalently to emitter current, and would have been expected to be cummulative thereto.

14. Claims 1-3, 6 and 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Van Loenen.

Van Loenen teaches a sub-micron process that deforms the surface by making a series of pits, which reads on etching, and uses the tip of a scanning tunneling microscope (Fig. 1-2) to which voltage pulses are applied, to form these pits. Fig. 3 a-c illustrates the digital signal to be inscribed (a); the voltage pulse to the tip electron emitter electrode (3b); and the pits made in the surface (3c). As noted in section 11 above the voltage pulse process inherently causes the claimed thermal spikes or shockwaves. It is taught that the tip may be positioned accurately (to

0.01 nm) in 3 mutually perpendicular directions (X,Y and Z) on col. 1., lines 24-42+; an exemplary round pit diameter is given to be 10 nm (col. 4, lines 50-61); operation of the microscope may be in vacuum using a cryogenic cooler, or it may be in air without vacuum or cooling (col.6, lines 28-35); the tip may be positioned at a distance of 0.1 to 1 nm from the surface so that electrons can travel between the tip and the surface with application of a "tunneling" voltage (col. 6, lines 36-68+). Also see the abstract; col. 3, lines 35-68.

15. Claims 4-5 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Loenen.

As above, claim 4 is included due to the ambiguity of the claim language, and since use of a planar anode electrode is a conventional, hence an obvious mode for completing the taught circuit structure in Van Loenen.

Specific times for voltage pulses and their resultant effects are not taught in Van Loenen, however routine experimentation with timing parameters to achieve taught dimension (10 nm) would have been expected to include time parameters as claimed in order to limit the localized heating caused by those pulses, which will determine size of effected area.

16. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Van Loenen as applied to claims 1-6, 8 and 12 above, and further in view of Wallace.

Van Loenen does not teach use of any specific gases with his etching process, however Wallace teaches use of various gases for cleaning, passivating, and deposition, including use of for example HF to clean (and passivate) Si surface, where conventional electron microscopes may be used in Wallaces process. See abstract; col. 3, lines 9-25; col. 4, lines 50-66; and col. 5, lines 20-53. It would have been obvious to one of ordinary skill in the art to include uses of

gases as employed in Wallace in process of Van Loenen, because Van Loenen also teaches silicon as a preferred substrate to be treated (col. 3, lines 35-41 and claim 3), hence the ability to clean (an etching process) and passivate the substrate surface with the same device used for pit formation would have been advantageous, and seen to be desirable in the types of substrates employed. Use for processes creating like scale surface features, is further evidence of the compatibility of these techniques.

17. Li et al is equivalent to Van Loenen for claims 1-3, 4 and 12-13.

18. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Van Loenen as applied to claims 1-6, 8 and 12 above, and further in view of Thompson (598), and optionally further considering Binnig et al.

While Van Loenen teaches use of cryogenic temperatures in their use of electron microscopes tip for pit formation which evaporates material from the substrate (as well as ambient temperature and pressure conditions), it is under vacuum situations, which is gas at cryogenic temperatures, not liquid. Binnig et al further demonstrates that for such microscopes, that cryogenic temperatures means liquid He temperatures (Abstract; Figures, esp. 1; col. 2, lines 49-col. 3, line 8 and lines 61-68^{+}).

The patent 3,720,598 to Thompson shows that arc discharges used to vaporize material, when surrounded with cryogenic fluid, such as liquid He, strongly constrain the arc discharge to rapidly quench the vaporized material, ensuring only localized heating. See the abstract; figures; col. 1, lines 29-68 (advantages) and summary. Given the teachings in Van Loenen, and optionally Binnig et al, it would have been obvious to one of ordinary skill in the art that Thompson's teaching of the advantages of the use of cryogenic liquid in which to perform arc

evaporated, would apply equally to Van Loenen's technique, because their electron microscope technique is essentially an arc discharge process, with cryogenic temperatures already recommended, and where the pressure used is not taught to be critical or important. The liquid He environment would have been expected to have been superior for quenching, rather than the vacuum which is cooled to the same temperature, because of the greater density of cryogenic atoms to provide the cooling, thus enabling control of the localized heating effect.

19. Claims 1-5 and 8-9 are rejected under 35 U.S.C. 102(b) as being anticipated by Inoue (3,663,788).

Inoue teaches use of two opposed spark discharge electrodes to treat and carry (i.e., via shockwave) particulate material (exemplary sizes about 0.1 mm or 100μm in EX. 1, or 300-mesh and 600 mesh (i.e., around 45μm and 20μm in Ex. II) to a substrate where it is deposited. Figures 1-5 illustrate that the flow of electrons is parallel to the substrate and to the mass of particles. Note that the particle size is within the claimed effected "area" size, so reads on the independent claim limitation. Fig. 14, demonstrates a tip configuration where electrons travel directly towards the powder which is to be treated. The voltage is taught to be supplied in a rapid series of pulses with col. 6, lines 30-35 disclosing a H.F. range of about 1 KC/sec to about 10 mc/sec. i.e., 10^3 to 10^7 cyles/sec, which corresponds to 1 msec/cyle to 100 nsec/cycle. Therefore pulse periods for voltage used thus the corresponding shockwaves may be on the order of 100 nanoseconds. Note that while what area of the substrate each pulse treats is not disclosed, it would inherently depend on geometry and the distance between the electrode and the substrate.

Also see the abstract; col. 2, lines 35- col. 3, line 39; col. 5, lines 44- col. 6, line 35; col. 7, lines 20-61 and col. 8, lines 50 – col. 9, line 30.

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to M L. Padgett whose telephone number is 703-308-2336. The examiner can normally be reached on Monday-Friday from about 8 am to 4:30 pm.

The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications and 703-305-6078 (informal).

M. L. Padgett/mm

October 7, 2002

MARIANNE PADGETT
PRIMARY EXAMINER